

Conservation and Transformation of Energy

PS-6 The student will demonstrate an understanding of the nature, conservation, and transformation of energy.

PS-6.9 Compare the functioning of simple series and parallel electrical circuits.

Taxonomy Level: 2.7-B Understand Conceptual Knowledge

Key Concepts:

Resistors wired in series

Resistors wired in parallel

Batteries made from cells wired in series

Batteries made from cells wired in parallel

Previous/Future knowledge: In the 4th grade students summarized the functions of the components of complete circuits (including wire, switch, battery, and light bulb) (4-5.6), and also illustrated the path of electric current in series and parallel circuits (4-5.7). In Physical Science students will expand their concepts of series and parallel circuits by comparing them and their functions.

It is essential for students to recognize and understand

Series Circuits:

- In a series circuit there is a single path for electrons.
- When another resistor is wired in series with the resistors in a circuit, the total resistance increases because all of the current must go through each resistor and encounters the resistance of each.
- The current in the circuit decreases when additional resistors are added.
 - When another light bulb is added to lights wired in series, the lights will dim.
 - The current will be the same in each resistor.
- When light bulbs are wired in series and one is removed or burns out all of the lights in the circuit go out. When the light bulb is removed from the circuit, it opens the circuit and current cannot flow.

Parallel circuits:

- When resistors are wired in parallel, there is more than one path that the electrons can travel.
- The voltage in each path is the same.
- When another resistor is wired in parallel, then the total resistance is reduced.
- The total current in the circuit will increase when another path is added.
- If light bulbs are wired in parallel and one bulb burns out or is removed, the other bulbs keep burning because the circuit is still complete.

Chemical cells in series and parallel:

- Chemical cells can be wired in series to make a battery.
 - Cells wired in series will increase the voltage of the battery.
- Chemical cells can be wired in parallel to make a battery.
 - Cells wired in parallel do not change the voltage of the battery.
 - Cells are wired in parallel to make the battery last longer.

It is not essential for students to

- Calculate the total resistance in a series or parallel circuit;
- Calculate the current in each branch of a parallel circuit;
- Calculate the total voltage of a battery when the cells are wired in series or parallel.

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Assessment Guidelines:

The objective of this indicator is to compare the functioning of parallel and series circuits, therefore, the primary focus of assessment should be to show similarities and differences between these circuits with regard to their structure and how these circuits function in different situations.

In addition to *compare*, students should be able to:

- Illustrate series and parallel circuits;
- Classify circuits as series or parallel;
- Summarize major points about series and parallel circuits;
- Infer the effects of changes in series and parallel circuits;
- Recognize series and parallel circuits.